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BACKLIT DISPLAYS

This invention relates to display devices, especially backlit display devices, and backlights for displays. The backlighting is suitably provided by means of organic light-emissive material.

Light-emissive organic materials are described in PCT/WO90/13148 and US 4,539,507, the contents of both of which are incorporated herein by reference. The basic structure of these devices is a light-emissive organic layer, for instance a film of a poly(p-phenylenevinylene ("PPV"), sandwiched between two electrodes. One of the electrodes (the cathode) injects negative charge carriers (electrons) and the other electrode (the anode) injects positive charge carriers (holes). The electrons and holes combine in the organic layer generating photons. In PCT/WO90/13148 the organic light-emissive material is a polymer. In US 4,539,507 the organic light-emissive material is of the class known as small molecule materials, such as (8-hydroxyquinolino)aluminium ("Alq3"). In a practical device, one of the electrodes is typically transparent, to allow the photons to escape the device.

Figure 1 shows the typical cross-sectional structure of an organic light-emissive device ("OLED"). The OLED is typically fabricated on a glass or plastic substrate 1 coated with a transparent first electrode 2 such as indium-tin-oxide ("ITO"). Such coated substrates are commercially available. This ITO-coated substrate is coated with at least a layer of a thin film of an electroluminescent organic material 3 and a final layer forming a second electrode 4 which is typically a metal or alloy. Other layers can be added to the device, for example to improve charge transport between the electrodes and the electroluminescent material.

Organic light-emissive materials have great potential for us in various display applications. One such application is as a backlight for transmissive or transflective liquid crystal displays. In a liquid crystal display there is typically a planar liquid crystal cell which has active regions where the optical properties of

the liquid crystal material can be altered by the application of an electric field to vary the transmission of light through the regions. In a transmissive liquid crystal display there is a light source behind the liquid crystal panel; and light from the source shines to a viewer through those of the regions through which light can be transmitted. In a transflective liquid crystal display the light source is supplemented by a reflective mirror, also behind the liquid crystal panel, which can return incident light towards the viewer.

The shape and layout of the active liquid crystal regions is generally defined by the pattern of electrodes in the LCD. Some patterns are specific to alpha-numeric or special character formats. An alternative is a general dot matrix display pattern, in which the active regions are usually arranged to provide an array of pixels. The pixels are normally arranged in an orthogonal grid layout, with the pixels arranged in mutually perpendicular linear rows and columns, but other layouts such as non-orthogonal grids are possible. The LCD pixels can be controlled by a conventional display controller.

Figure 2 shows a schematic plan view of the basic structure of a passive-matrix LCD. There are orthogonal row 10 and column 11 lines of a transparent conductor such as ITO. These form the electrodes. The row and column lines are separated in the plane of figure 2 by the liquid crystal layer itself. (For simplicity other LCD components such as polarisers, alignment layers, the liquid crystal layer and colour filters are omitted from figure 2). The areas where row and column lines overlap define the active regions (pixels) of the device (e.g. at 13), which can be addressed by applying a voltage between the relevant row and column lines. Because the column lines run across the row lines it is not possible to individually address all the pixels at the same time. Instead, the pixels are addressed with a row-by-row scan. An alternative drive arrangement for an LCD is the active-matrix arrang ment, in which each pixel has individual control circuitry, which can conveniently be in the form of thin-film transistors (TFTs), to allow more continuous driving of the pixels.